Appendix A.
Estimating the Bycatch of Sea Turtles in Fisheries

For this biological opinion, NMFS used the delta-lognormal method of bycatch analysis, which is the same method used in the June 30, 2000 Opinion. Estimates using this method are based on quarterly observed effort and grouped by six fishing areas or NAREAs. Due to the random nature of the sampling and relatively low sampling fractions, not all time-area-strata have been observed. Thus, pooling observations between strata is necessary to estimate fleet-wide bycatch. To avoid missing or poor estimates where there are no or very few observation units (set) in a basic year-quarter-NAREA stratum, a criterion is set so that if a basic stratum has less than 5 observed sets, the levels of quarter, year, and then NAREA will be pooled successively in that order until **N min** is reached. Pooling is necessary only in the offshore NAREAs of CAR, OFS, and NED and only up to the level of quarters, with rare exceptions. Then **N min** of 5 is selected in an attempt to balance the need for reasonable estimates and preserving inherent variability among strata. The main objective is to avoid leaving empty cells with no estimates available. A similar pooling method was used to estimate refined catch of commercial species (tuna and swordfish) from the U.S. Atlantic pelagic longline fishery with results similar to values reported in the commercial landings reporting system (Brown *et al.* 2000).

This newer methodology appears to be more accurate and appropriate than that used in previous analyses of these data (those that pre-date NMFS' June 30, 2000 Opinion), which did not account for effort in unobserved areas and would obviously ensure negative bias in the estimates. These latest estimates are somewhat higher than the Yeung *et al.* (2000) estimates used in the June 30, 2000 Opinion–and Yeung *et al.*'s estimates were higher than those previously reported. Apart from previous systematic revisions to the data sets since the previous reports that may have led to changes, the effort data were treated slightly differently compared to previous reports, which may explain the slightly higher 2001 estimates. The fishing location was previously defined where the haul-back of the longline was set to begin fishing, but in the latest analysis it was defined by the location where the haul-back of the longline began after fishing. Also, the parts of a set that were interrupted (*e.g.* when the main line was severed) previously were defined as separate sets, but now are combined as a single set.